SCHOOL CHEMISTRY

CLASS 6

Laboratory Manual

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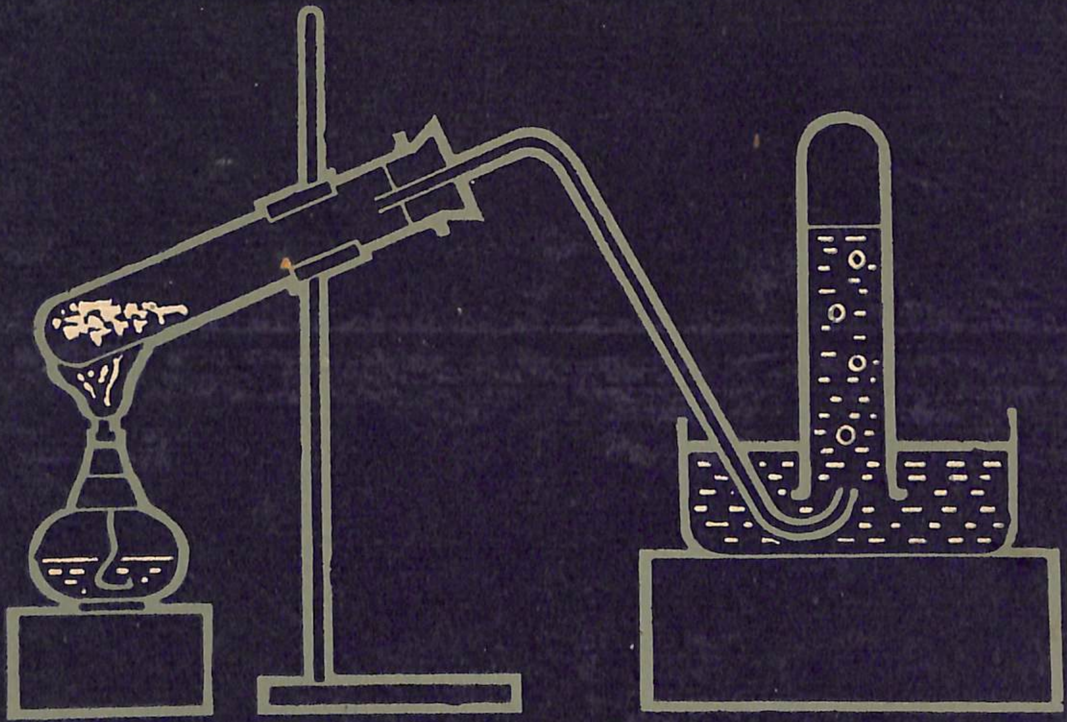

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NCERT CHEMISTRY STUDY GROUPS

EXPERIMENTAL EDITION

8799

SCHOOL CHEMISTRY

CLASS 6

LABORATORY MANUAL

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STATE INSTITUTE OF EDUCATION
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SCHOOL CHEMISTRY

CLASS 6

LABORATORY MANUAL

Prepared by

NCERT Chemistry Study Groups

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PREFACE

The Education Commission recommended that teaching of science should commence at class 5 with physics and biology as separate disciplines and at class 6 with chemistry. This recommendation has been accepted by the Ministry of Education, Government of India and in pursuance of this, the National Council of Educational Research and Training has set up Study Groups to draw up a curriculum and develop teaching materials in various disciplines.

The Chemistry Study Groups, after long deliberation, considered it necessary that a new approach should be made to the study of chemistry at the school level. Essentially this approach is based upon pupil experimentation followed by teacher's demonstration and a discussion leading to an understanding of the principles of chemistry. Accordingly the laboratory manual and text have been prepared for classes 6 and 7. The pupil is expected to carry out the experiments described in the laboratory manual either individually or in groups as indicated. In this approach, the pupil, apart from learning about the behaviour of substances, has also the thrill of finding something new all by himself. The teacher's demonstrations supplement the experimental work done by the pupils and lead to further discussion of the basic principles of chemistry.

For conducting these experiments it is not absolutely necessary to have a separate laboratory ; they can be carried out in a class room provided with suitable flat desks. The equipment needed is also of a simple and inexpensive nature.

The project was started in September 1966 and after several meetings of the Study Groups, a broad outline of the curriculum was drafted and later, the writing of the Laboratory Manual, Text and Teacher's Guide was undertaken. Some of the material prepared was tried out in a few schools, outside the normal curriculum, to find out the response from the pupils. The response has been encouraging, especially because of the experimental work involved.

The Directors and members of the Study Groups are conscious of the shortcomings and limitations of the material, which was prepared by assuming a certain level of knowledge on the part of the teacher. The practical difficulties in implementing the course will be obvious only after trial for a full academic year. For this reason the present material is being brought out as an experimental edition which will undergo revision in the light of the experience gained by trying it out in a number of schools. Helpful comments and suggestions for improvement of the Laboratory Manual as well as the Text will be gratefully received.

I will be failing in my duty, if I do not acknowledge the valuable help given by the Directors and members of the staff of the Study Groups as well as the staff of the Department of Science Education, National Institute of Education, New Delhi, in the preparation of this experimental edition. But for the financial support given by NCERT and encouragement by Dr. D. S. Kothari, Chairman, University Grants Commission, and Mr. L. S. Chandrakant, the then Joint Director of the NCERT, the project would not have taken shape. The Directors and members of the Study Groups gratefully acknowledge their help and encouragement.

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St. Ann's Girls' High School, Secunderabad.
Nrupatunga Multipurpose High School, Hyderabad.
R. K. Mission High School & Church Park Convent, Madras.
Kendriya Vidyalaya, Vallabh Vidyanagar.
D. N. High School & Kasturba Kanya Vidyalaya, Anand.
Shri Vividhalakshi Vidyamandir, Palanpur.
Sardar Patel High School, Boriavi.

They appreciate the services rendered by Sri G. Sivaram, artist, in preparing the illustrations.

Osmania University,
HYDERABAD-7.

N. V. SUBBA RAO
Convener
NCERT Study Groups in Chemistry.

DIRECTORS AND MEMBERS OF THE STUDY GROUPS

Convener	Prof. N. V. Subba Rao, Osmania University, Hyderabad.
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	Sri Venkobacharya Upadhyaya, Osmania University, Hyderabad.

MEMBERS ASSOCIATED WITH THE STUDY GROUPS

Sri G. Y. Dixit,
N. M. V. High School, Poona.

Dr. Gurdev Singh,
Panjab University, Chandigarh.

Sri D. V. Kelkar,
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Panjab University, Chandigarh.

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Sardar Patel University, Vallabh Vidyanagar.

Dr. M. R. Patel,
Sardar Patel University, Vallabh Vidyanagar.

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Sardar Patel University, Vallabh Vidyanagar.

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Sardar Patel University, Vallabh Vidyanagar.

Dr. K. C. Patel,
Sardar Patel University, Vallabh Vidyanagar.

Dr. S. R. Patel,
Sardar Patel University, Vallabh Vidyanagar.

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University of Poona, Poona.

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Vithalbhai Patel Mahavidyalaya, Vallabh Vidyanagar.

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Sri C. S. Venkataraghava Chari,
Kallet High School, Madras.

Sri N. Venkoba Rao,
Nrupatunga Multipurpose High School, Hyderabad.

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LABORATORY INSTRUCTIONS

1. Before coming to the laboratory, study carefully the instructions for conducting the experiment. Make a note of the precautions and exact measurements to be made.

2. New experiments may be done after consulting the teacher.

3. Record of the laboratory work must be submitted after each laboratory session.

4. Use only the required amounts of chemicals.

5. Do not touch chemicals with your hand unless directed to do so.

6. Do not taste any substance unless you are asked to do so by your teacher.

7. Use only matches (not strips of paper) to light your spirit lamp. Put out a lighted matchstick before throwing it away.

8. Never throw matches, filter paper or solids in the sink. Place them in the waste paper basket provided.

9. When heating substances in test tubes, make sure that the open end is pointed neither at your neighbour nor at yourself.

10. While handling hot articles, use a pair of tongs and keep them on an asbestos plate.

11. Never smell any gas or volatile substance directly. Waft the vapours towards you and smell.

12. Keep your apparatus and table clean. Avoid any spilling. If you spill something, clean it up immediately.

13. As far as possible see that your clothing do not touch the surface of the working table.

14. Do not pour concentrated acids into the sink. Pour them into a bucket containing water.

BURNS AND ACCIDENTS

1. If any accidents occur while doing the experiment, report at once to your teacher.
2. In the case of acid burns, wash at once with a dilute solution of sodium bicarbonate and water and then apply an ointment of vaseline and boric or picric acid. For other burns apply only the ointment.
3. In the case of minor cuts, wash the spot with ferric chloride or alum solution until the bleeding stops. Apply cotton gauze soaked in tincture benzoin if it is a major cut.
4. If harmful chemicals fall on your skin, or in the eyes or in the mouth, dilute and flush them off with plenty of water. Then report to your teacher for first aid.

UNIT I

CHEMISTRY AND THE MATERIAL WORLD

Chemistry deals with the composition of matter and the changes it undergoes. In this unit you will do some experiments which will give you an idea of some of the properties of a few substances and the changes they undergo when heated or exposed to air.

While doing these experiments, you will learn some of the laboratory techniques such as dissolving a substance, decantation, filtration and evaporation.

I

STUDY OF SOME COMMON SUBSTANCES

In this experiment you will study some substances with regard to their state, colour and solubility.

Materials Required

Beakers (100 ml)	2
Test tubes	6
Corks	2
Handlens	

Procedure

Observe the state, colour and smell of the given substances. Place one of them in water taken in a clean beaker. Stir with a glass rod and see whether it dissolves or not. Throw away the contents and wash the beaker. Repeat the experiment with the other substances. Record your observations in the tabular form given below :

Note : Use the handlens for observing solids.

No.	Name	State	Colour	Smell	Does it dissolve in water ?	Any other observations

Question

Name three solid substances other than those you have studied.

2

STUDY OF A SPIRIT LAMP

In this experiment you will examine various parts of a spirit lamp and assemble them. You will also learn how to use the spirit lamp.

Materials Required

Parts of a spirit lamp	1 set
Box of matches	
Funnel	
Spirit	25 ml

Procedure

Study the various parts of the spirit lamp and assemble them as shown by your teacher.

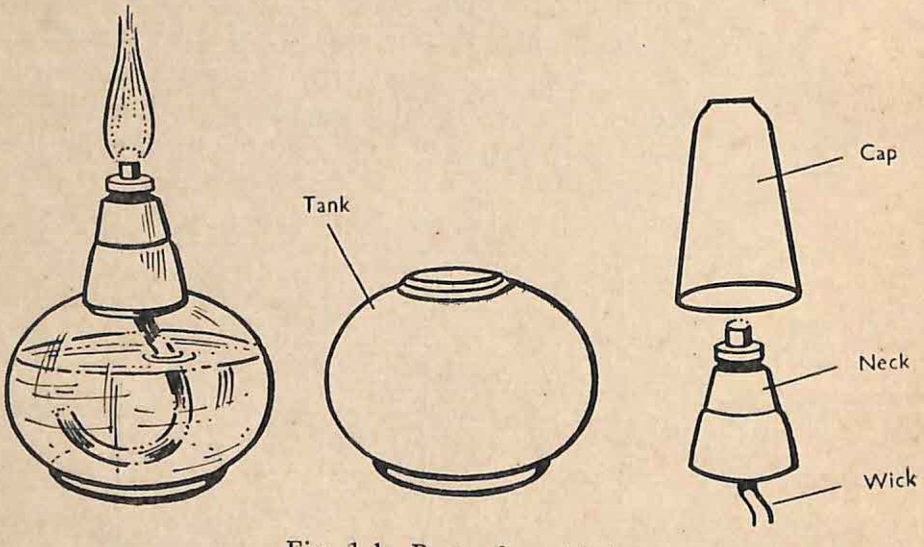

Fig. 1.1 Parts of a spirit lamp

Note down the functions of each part. Using the funnel, fill the tank upto three-fourths with spirit. Fit in the neck and wipe the lamp with a piece of cloth and then light the wick. To put out the flame, place the cap over the neck of the lamp.

Precautions

1. Keep the bottle containing spirit away from the flame.
2. Do not fill the lamp with spirit when it is burning.

Questions

1. What is the wick made of?
2. How do you get a good flame with a spirit lamp?
3. What materials are used up when the lamp burns?

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3

BEHAVIOUR OF SUBSTANCES ON HEATING

In this experiment you will heat some substances and observe the changes they undergo.

Materials Required

Test tube holder		Nichrome wire	4 cm
Pair of tongs		Clean magnesium ribbon	4 cm
Hard glass test tubes	3	Ammonium chloride	0.5 g
Box of matches		Copper sulphate	0.5 g
Spirit lamp		Lead nitrate	0.5 g

Procedure

a. Note the appearance of nichrome wire. Hold it with a pair of tongs and heat it in the flame for about 3 minutes. What happens ? Remove it from the flame and wait for a minute. Observe its appearance. Record your observations.

b. Hold the magnesium ribbon with a pair of tongs and heat it in the flame for about 2 minutes. Then remove it from the flame and hold it over a paper. Record your observations.

c. Take about 0.5 g each of ammonium chloride, copper sulphate and lead nitrate in separate, dry test tubes and heat. While heating, hold the test tube slightly inclined by means of a test tube holder and keep the mouth of the test tube away from you.

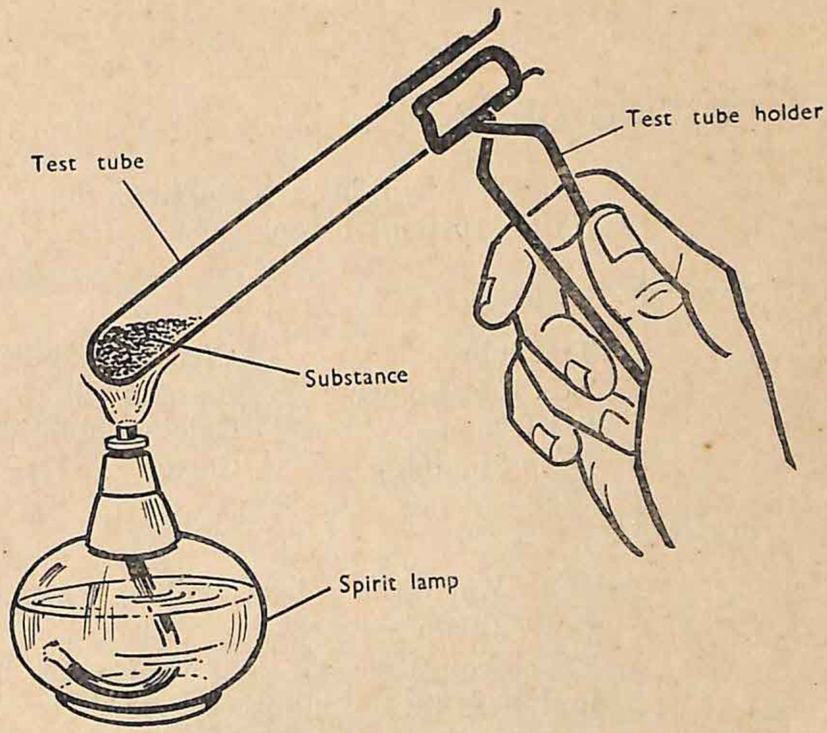

Fig. 1.2 Heating of a substance

Record your observations.

Precaution

Do not inhale large amounts of gases as they may be poisonous. Keep the test tube at a distance from you, waft the vapours towards your nose and note the smell of the gases.

Question

Do all the substances behave similarly when heated?

4

RUSTING OF IRON

You will investigate here the conditions responsible for the rusting of iron.

Materials Required

Test tubes	3	Clean iron nails (small)	9
Test tube holder		Paraffin oil	1 ml
Spirit lamp		Calcium chloride (anhydrous)	5 g
Box of matches		Cotton	1 g

Procedure

Take three iron nails in a clean test tube and add water to cover them completely. Keep the test tube aside. Take about the same volume of water in another test tube and boil for a minute to expel the dissolved air. Drop quickly three iron nails into the water and add five drops of paraffin oil to form a layer on the water so as to prevent air from dissolving. Leave the test tube aside.

Place three iron nails in the third test tube. Push cotton plug half way down the tube. Place anhydrous

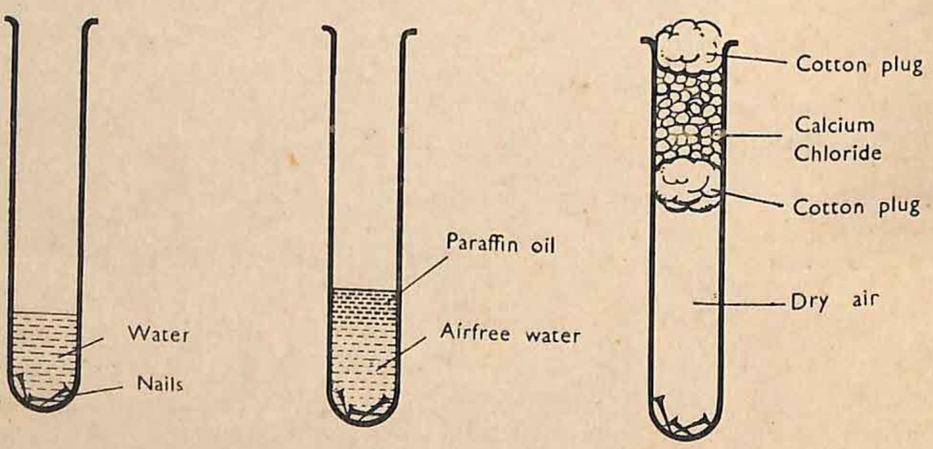

Fig. 1.3 Rusting of iron

calcium chloride over it to keep the air in the tube dry. Close the mouth of the tube with another cotton plug. Leave this test tube also aside.

Observe the appearance of the nails after 3 days in all the test tubes and record.

Question

What are the conditions that favour the rusting of iron ?

5

SEPARATION OF THE COMPONENTS OF A MIXTURE

In this experiment you will separate sand and salt from a mixture of the two. The separation is based on the fact that salt is soluble in water whereas sand is not. You will also learn simple manipulations like decantation, filtration and evaporation.

Materials Required

Beakers (100 ml) 2
Funnel
Filter stand
Filter paper circle
Tripod
Evaporating dish (100 ml)
Wash-bottle
Wire gauze
Glass rod
Pair of tongs
Asbestos mat
Box of matches
Mixture of salt and sand 5 g

Procedure

Take the given mixture of sand and salt in a beaker. Add a test tube full of water. Stir well till all the salt dissolves. Using a glass rod decant the clear liquid into the filter cone fitted in a funnel. Collect the filtrate in a beaker. Transfer the residue into the filter. Wash the residue with small amounts of water from a wash-bottle. Collect the washings also in the same beaker. When the water drains off completely, take out the filter paper from the funnel with care. Open it and allow the residue to dry in air.

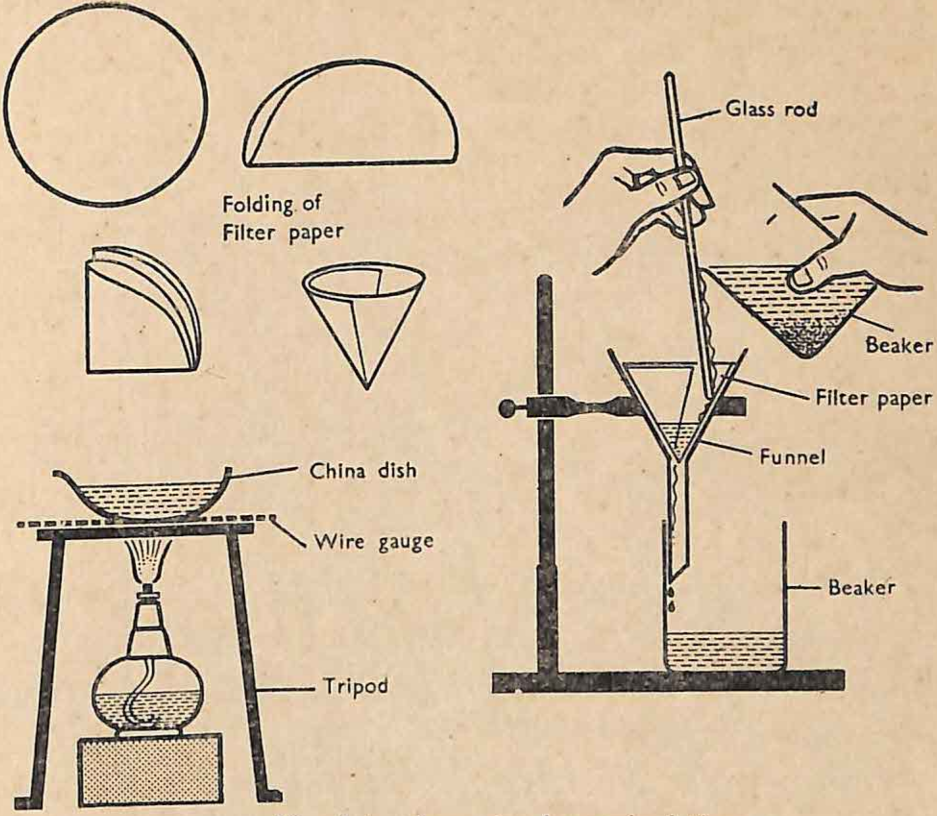

Fig. 1.4. Some simple manipulations

Transfer the filtrate and washings into a clean evaporating dish. Place the dish on the wire gauze and heat it. Stir the solution occasionally with a glass rod to avoid spurting.

When the evaporation of the solution is nearing completion, remove the spirit lamp and put out the flame. Allow the solution to dry. Remove the evaporating dish using a pair of tongs. Place it on an asbestos mat and allow it to cool. Scrape out the salt on a piece of paper.

Questions

1. Can we separate salt from sugar by this method? Explain.
2. What is the function of the filter paper?
3. How is salt obtained from sea water?

UNIT 2

STRUCTURE OF MATTER

Matter exists in three states—solid, liquid and gaseous. To understand the nature of matter, it is necessary to examine its properties. In this unit you will perform some experiments on the behaviour of gases and solids.

6

GAS EXERTS PRESSURE

In this experiment you will learn that air occupies space and exerts pressure.

Material Required

Rubber balloon

Procedure

Blow air into the balloon and note its appearance. Feel the tension on the walls of the balloon while air is being blown into it.

Let out some air from the balloon until its size decreases to about half the initial size. Feel the tension again.

7

EFFECT OF PRESSURE ON THE VOLUME OF A GAS

In this experiment you will find how the volume of a given amount of gas changes with pressure.

Materials Required

Syringe (10 ml)
U tube
Rubber tubing

Procedure

Pull the piston of the syringe until it stands at the 10 ml mark. The barrel contains 10 ml of air.

Close the tip of the nozzle tight with the fore-finger of your left hand. Push the piston with your right hand to different positions along the barrel and note the volume of air every time.

Add coloured water to a small U tube such that the water stands at a height of atleast 6 cm. Pull the piston of the syringe again until it stands at the 10 ml mark and connect the nozzle to the U tube by means of a rubber tubing. Push the piston forward by 2 divisions and observe the difference in the levels of the water in the two limbs of the U tube. Push it by 2 more divisions and observe the difference in the levels of water.

Question

When the piston is pushed half way into the barrel

a. what happens to the volume of air inside the barrel

b. does the pressure of air inside the barrel increase or decrease ?

8

EFFECT OF TEMPERATURE ON THE VOLUME OF A GAS

In this experiment you will learn how the volume of air changes with temperature.

Materials Required

- Boiling tube
- Trough
- Box of matches
- Spirit lamp
- Rubber stopper carrying a delivery tube
- Iron stand with adjustable clamp

Procedure

Fit the apparatus as shown (Fig. 2.1)

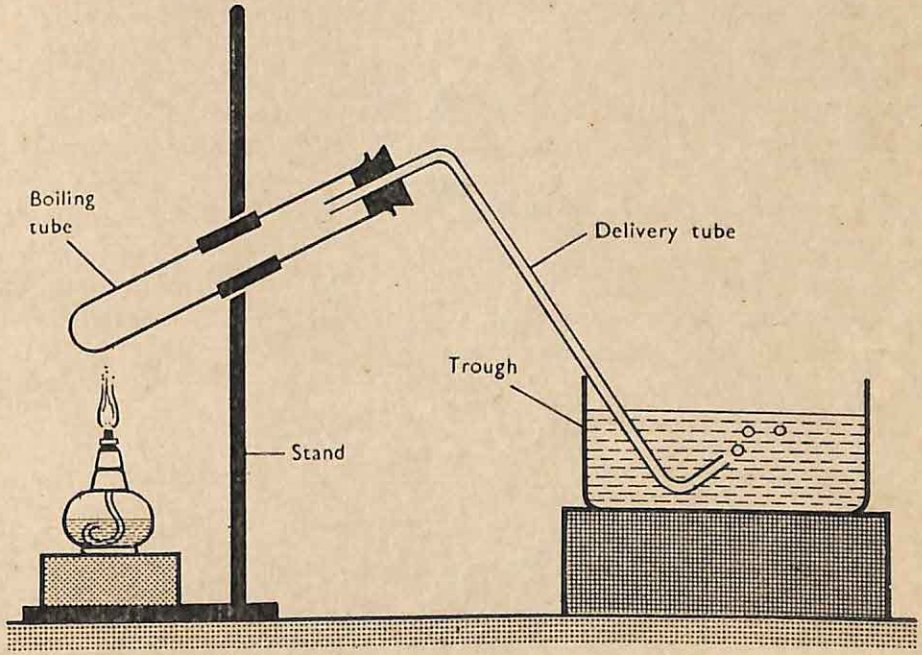

Fig. 2.1 Air expands on heating

See that the end of the delivery tube is under the water in the trough. Make sure that the rubber stopper is tightly fitted to the boiling tube.

Heat the boiling tube gently (the tip of the flame should be at least 10 cm below the boiling tube).
Observe what happens.

Continue heating until about 20 bubbles come out. Remove the spirit lamp and allow the tube to cool. Notice the level of water in the delivery tube.

Precaution

Use a *dry* boiling tube.

Questions

1. What happens to the volume of air when its temperature is
   - a. increased and
   - b. decreased?
2. Explain why cycle tubes sometimes burst in summer.

9

ELECTRICAL NATURE OF MATTER

In this experiment you will learn that a dry comb attracts bits of paper when rubbed briskly with silk.

Materials Required

Plastic comb
Piece of pure terylene
or silk cloth about 25 cm square
Small bits of paper
Beaker (250 ml)

Procedure

Bring the clean and dry comb near the small bits of paper. Observe whether the comb picks up the bits of paper.

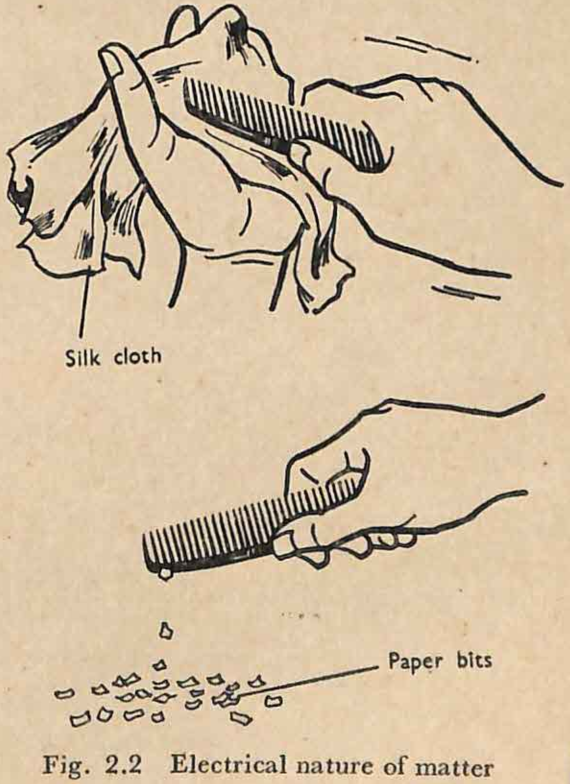

Fig. 2.2 Electrical nature of matter

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Rub the comb briskly about 25 times with the silk cloth. Now bring it near the small bits of paper. Notice what happens.

Question

Did you ever notice hair on your skin standing up on taking off a terylene shirt? If so, give the reason for it.

UNIT 4

SOLUTIONS

Many chemical reactions are known to take place in solution. In this unit you will carry out some experiments which will give an idea of the nature of a solution, factors affecting the rate of dissolution and the changes accompanying the formation of a solution.

10

PREPARATION OF A SOLUTION (SOLID IN LIQUID)

In this experiment you will prepare a solution of potassium permanganate in water and examine its nature.

Materials Required

Beaker (100 ml)
Glass rod
Potassium permanganate 0.1 g

Procedure

Take 50 ml of water in a beaker. Add 2 or 3 crystals of potassium permanganate. Note what happens during the course of five minutes. Stir the solution with a glass rod and observe the changes.

Questions

1. What is the colour of potassium permanganate crystals?
2. What happened immediately after the crystals were put in water?
3. Was the colour of the solution uniform after five minutes?
4. Was the colour of the solution uniform after stirring?

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11

HEAT CHANGES ACCOMPANYING DISSOLUTION OF SUBSTANCES IN WATER

In this experiment you will find out if there is any change in temperature of water when ammonium chloride, sodium hydroxide and sodium chloride are separately dissolved in it.

Materials Required

Test tubes (20 ml)	3	Ammonium chloride	1 g
Glass rod		Sodium hydroxide *	1 g
		Sodium chloride	1 g

* Sodium hydroxide is corrosive and should be handled with a spatula.

Procedure

Take 5 ml of water in a test tube. Touch the tube and note whether it is hot or cold. Add 1 g of ammonium chloride and stir with a glass rod till it dissolves completely. Touch the tube again and note whether it is hotter or colder than before.

Repeat the experiment with sodium hydroxide and sodium chloride. Record your observations.

12

FACTORS AFFECTING THE RATE OF DISSOLUTION

In this experiment you will learn the effect of particle size, stirring and heating on the rate of dissolution of candy in water.

Materials Required

Beakers (250 ml) 2
Measuring cylinder (100 ml)
Glass rod
Wire gauze
Tripod stand
Spirit lamp
Mortar and pestle
Candies* of equal size 6

* (Pippermints or lemon drops may also be used).

Note : Use clean beakers for each part of the experiment.

Procedure

a. Particle size

Label two beakers A and B. Take a candy in beaker A. Powder another candy and take it in beaker B. Add 100 ml of water simultaneously to both the beakers. Observe in which case the candy dissolves more readily. Throw away the solutions and wash the beakers.

b. Stirring

Powder one piece of candy and place it in beaker A. Powder another candy and place it in beaker B. Add 100 ml of water to each beaker Leave beaker A undisturbed. Stir the contents of beaker B with a glass rod for 2 minutes. Record your observations.

c. Heating

Take equal amounts of powdered candy in each of the beakers A and B. Add 100 ml of water to each beaker. Leave beaker A undisturbed.

Heat the contents of beaker B gently on a wire gauze for 2 to 3 minutes. Observe in which beaker the powdered candy dissolves quicker.

Questions

1. In which beaker did the candy dissolve first?
2. What is the effect of stirring on the rate of dissolution of powdered candy?

13

PURIFICATION OF A COMMERCIAL SAMPLE OF COPPER SULPHATE

In this experiment you will obtain a pure sample of copper sulphate from a commercial sample by crystallisation.

Materials Required

- Beaker (100 ml)
- Evaporating dish
- Glass rod
- Funnel
- Funnel stand
- Filter paper
- Wire gauze
- Tripod
- Asbestos mat
- Pair of tongs
- Spirit lamp
- Magnifying glass
- Box of matches
- Copper sulphate 2 g

Procedure

Take 20 ml of water in a beaker. Add the given quantity of copper sulphate in small portions with stirring. When all the copper sulphate has been added continue stirring to complete the dissolution.

Fix a filter paper in the funnel. Filter the solution of copper sulphate. Collect the filtrate in the evaporating dish. Heat the dish on the wire gauze kept on the tripod stand. Stir the solution to avoid spurting.

When a crust of salt begins to form on the solution, remove the dish and place it on an asbestos mat. Allow it to cool. Decant the mother liquor. Transfer the crystals from the dish on to a filter paper using a glass rod. Dry the crystals between folds of filter paper.

Take a crystal on a piece of paper and observe it through a magnifying glass.

14

PREPARATION OF SOLUTIONS OF DIFFERENT CONCENTRATIONS

In this experiment you will prepare copper sulphate solutions of different concentrations and find the relationship between concentration and colour of the solution.

Materials Required

Glass rods	2	Copper sulphate	2.5 g
Test tubes	2		

Procedure

Take 15 ml of water in each test tube. Add 0.5 g of copper sulphate to one test tube and 2.0 g to the other and stir till the solids dissolve.

Keep the test tubes side by side against a white background. Note in which of the test tubes the colour of the solution is deeper.

15

THE SOLUBILITY OF SOLIDS IN VARIOUS LIQUIDS

In this experiment you will find out which of the given solvents dissolve substances like iodine, naphthalene and paraffin wax.

Materials Required

Test tubes with corks	6	Naphthalene	1 g
Test tube brush		Paraffin wax	1 g
Chalk powder	1 g	Sodium chloride	1 g
Copper sulphate	1 g	Kerosene	20 ml
Iodine*	1 g	Methylated spirit	20 ml

*Iodine is a corrosive substance and should be handled with a spatula.

Procedure

Take a small quantity of iodine in a test tube. Add 5 ml of water, cork the test tube and shake for 1 or 2 minutes. See whether the iodine dissolves in water.

Repeat the experiment using

a. iodine and 5 ml of methylated spirit and

b. iodine and 5 ml of kerosene

Similarly test the solubilities of common salt, paraffin wax, naphthalene, chalk powder and copper sulphate. Record in the tabular form given below whether each of the substances dissolves in the given solvent or not.

No.	Substance	Water	Methylated spirit	Kerosene
1.	Iodine			
2.	Sodium chloride			
3.	Paraffin wax			
4.	Naphthalene			
5.	Chalk powder			
6.	Copper sulphate			

16

MISCIBILITY OF LIQUIDS

In this experiment you will find out whether the liquids in a given pair are miscible with each other or not.

Materials Required

Test tubes with corks	4	Denatured spirit	10 ml
Graduated test tube*		Kerosene	10 ml
		Vegetable oil	10 ml

**Calibration of a test tube*

Paste a thin strip of white paper along the length of a test tube. Pour water, with the help of a dropper, up to the 1 ml mark into a 10 ml measuring cylinder and transfer it to the test tube. Make a mark on the paper strip at the level of the water surface in the test tube. Pour one more ml of water from the measuring cylinder to the test tube and mark the level of water which now measures 2 ml. Repeat this process till the test tube is marked to read up to a volume of 10 ml. You can now use this test tube as a measuring cylinder. *Preserve this for your future experiments.*

Procedure

Take 5 ml of water in a test tube. Add 1 ml of denatured spirit. Shake for 2 minutes and see what happens. Add another 1 ml of spirit, shake and notice what happens. Continue till a total of 5 ml of spirit has been added.

Repeat the above experiment using

a. water and kerosene

b. water and vegetable oil and

c. kerosene and vegetable oil

Record in the tabular form given below whether the liquids in a given pair are miscible or immiscible.

No.	Pair of liquids	Observations
1.	Water + denatured spirit	
2.	Water + kerosene	
3.	Water + vegetable oil	
4.	Kerosene + vegetable oil	

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